A Short Study of

THE ETIOLOGY OF CHLOROSIS

A Thesis presented for the Degree of

M. D.

University of Edinburgh.

M.B., Ch.B.
M.R.C.P.

April 1906.

S Y N O P S I S

------- -------

INTRODUCTORY.

In making this subject the basis of a thesis I was prompted to do so for the following reasons.

The cause of the disease is as yet unknown. Professor Osler[1] in his Practice of Medicine defines the condition as "An anaemia of unknown cause, occurring in young girls, characterizedby a marked relative diminution of the haemoglobin". The studies of the Etiology of Chlorosis have been many and varied, and numerous conditions have been cited as predisposing or exciting causes of the disease, but although it is rendered evident that the disease results under very many diverse conditions, still, the essential factor in the evolution of the disease is as yet undetermined.

As the disease is a common one, I thought it likely that material for observations would be easily procurable.

The condition/

The condition occurring as it does for the most part in the domestic servant class, is a matter of some importance to the general public, as well as to the medical profession. Servants are very often unfitted for their duties on account of repeated attacks of this ailment, and if a cause could be found for the disease, and a means of prophylaxis brought forward, a great boon would be provided for many households.

H I S T O R Y.

The Etiology of Chlorosis has received attention for many years, by many men, and one finds that the work done is enormous, and the theories supported by important facts, and advocated by men well known to medical science, to be numerous and sometimes conflicting.

The theories which receive most support at the present day are the following:-

Intestinal/

Intestinal Auto-intoxication.

This theory has been advocated by many writers and observers, not only in Britain, but also in America, and on the Continent.

The earliest I find who has dealt with the subject in Britain is Sir Andrew Clark.[2] Bouchard[3] brought the subject into notice about the same time on the Continent. Other supporters of this suggested cause were:- Hoffman,[4] Nothnagel,[5] Forchheimer,[6] and among others Bunge[7] who stated that "the blood obtains iron solely from the nucleo-albumens, the iron from which is combined with sulphur during intestinal putrefaction, and thus becomes non-absorbable". On account of this he averred that the treatment of Chlorosis by Iron is explained - "The iron given by the mouth combines with the sulphides and permits the normal absorption of the nucleo-albumens".

Von Noorden,[8] Lipman & Wulf,[9] and Stockman,[10] have each brought forward evidence against Intestinal Auto-intoxication/

Intestinal Auto-intoxication as being the cause of Chlorosis, such evidence I shall consider more fully later.

Defective Development of the Generative Organs.

Great hopes were inspired, when Virchow[11] corroborated the views of Rokitansky[12] and showed that a Hypoplasia of the Genital Organs existed in a group of cases. In his cases, a Hypoplasia of the Circulatory Organs accompanied the Hypoplasia of the Genital Organs, but that has since been proved to be a more likely factor in the causation of Cardiac Disease.

This theory of Virchows has been passed over in the face of other evidence, but whether it is right to overlook it altogether, I shall endeavour to discuss under another heading.

Vasomotor Neurosis.

More recent observers have regarded the condition/

condition to be due to a Vasomotor Neurosis.

Murri[13] supposed that "there is a vasomotor disturbance arising from the generative organs, and causing changes first in the flow, later in the chemistry of the blood".

Grawitz[14] has stated his belief that "the disease is a vasomotor neurosis, with secondary changes in the blood, consisting in an increase of plasma, which infiltrates the red cells and replaces the haemoglobin. This condition is brought about by a disturbance in the interchange of fluids between the blood and the tissues, leaving an excess of fluid in both". That the cells are at the same time deficient in haemoglobin, he explained as the result of the imbibition of fluids by their progenitors in the bone-marrow. In support of this belief he emphasized the nervous phenomena of the disease, and referred to the fact that the symptoms are often out of proportion to the changes in the blood, which when/

which when severe he attributed to complications. He regarded the initial loss of weight which many chlorotics suffer in the beginning of treatment, as a sign of general reduction of body fluids. He also believed that there is a hypertrophy of the spleen commonly associated with chlorosis, and that this is an indication of disturbance of the function of this organ which results in an increased destruction of haemoglobin. This disturbance of function he believed to arise through irritation of the sympathetic, in the genital organs, stomach, intestines, etc. .

Meinert[15] has stated that the nervous influence arises from irritation of the abdominal sympathetic, and results from gastroptosis.

The Theories of Murri, Crawitz, and Meinert, do not appear to be altogether based on facts. A gastroptosis is not present in every case of chlorosis. Nervous symptoms are not well marked in all cases, and those symptoms which are most often associated/

associated with the disease, such as headache,and neuralgia, would seem to be explained satisfactorily when attributed to the anaemia.

The first essential for the discovery of the cause of any disease, is to ascertain if there is any factor which is constant, preceding the onset or during the earlier part of the course of the malady. Such a factor may then be suspected of having been responsible for the establishment of the disease.

TO enumerate the conditions generally associated with chlorosis,I shall give a brief summary of the symptoms and state of the blood in a few such cases.

Symptoms, and STATE of the BLOOD in Chlorosis.

The following are the symptoms, and results of the blood examination, of eight cases admitted for treatment to the Royal Infirmary Edinburgh, under the charge of Sir Thomas R. Fraser, during my term as resident physician in his wards.

Case 1.

Mary H--. Age 16. Shooting Saloon Attendant.

The patient was a plump girl with brilliant eyes, a pink and white complexion, and bluish sclerotics. The conjunctivae, lips and gums were pale. The lower lids were oedematous. She had a sad expression and was occasionally depressed. She suffered from headaches. The teeth were in very good condition.

She complained of pain in the epigastric region. Vomiting had occasionally followed the taking of food before her admission to the Infirmary. Her appetite was capricious. She complained of thirst.

There was/

There was tenderness on palpation over the epigastric region.

She had been constipated for some years, in fact as long as she could remember. Her bowels moved on the third, fourth, or fifth days, and sometimes she went as many as six days without a motion, before admission.

She suffered from palpitation and shortness of breath on exertion. Haemic bruits were heard at the pulmonary, aortic, and mitral areas, and a bruit de diable was heard at the root of the neck over the great veins, being especially audible on the right side.

Menstruation began at the age of fifteen. She menstruated twice and then had amenorrhoea up to the date of her admission into hospital. The quantity of blood lost was small, and the periods were accompanied by much pain, and for the first day by sickness and vomiting.

The spleen was not enlarged.

Blood Examination/

Blood Examination.

The freshly drawn blood was pale red in colour. The Red Corpuscles numbered 3,770,000 per cmm. The Leucocytes numbered 8,000 per cmm. The percentage of Haemoglobin was 41. The Specific Gravity 1041, and the ColourIndex.54 . An examination of a blood-film showed the red cells to be paler than normal with some variation in size, but no variation in shape. Numerous Blood Platelets were present.

Case 2.

Minnie H--. Age 19. Domestic Servant.

The patient was a very well-nourished girl. Her complexion was of a pale yellow-green tint. Her conjunctivae, lips,and gums, were pale, her eyes brilliant, and the sclerotics of a blue colour. There was no sign of oedema. Her teeth were good but coated with tartar.

She complained of breathlessness and palpitation on exertion. Haemic bruits were audible at the pulmonary, aortic, and mitral areas, and a distinct/

distinct bruit de diable was heard on both sides over the great veins at the root of the neck.

She had no appetite for food, and had suffered from occasional attacks of vomiting immediately after taking food, before her admission into hospital. There was tenderness on palpation over the epigastric region.

There was no history of constipation,her bowels had moved regularly every day.

Menstruation began when patient was 14 years of age,occurring every 4 weeks, and lasting 4 days. For some time just previous to admission the periods had returned every 3 weeks. The quantity of blood lost was small,Dysmenorrhoea present . There was no intermenstrual discharge.

The spleen was not enlarged.

Blood Examination.

The blood as it came fresh from the prick was pale red in colour and of watery consistence. The red cells were paler than those of normal blood, poikilocytosis/

poikilocytosis was marked, and the blood platelets very numerous.

Erythrocytes 2,470,000 per cmm.

Leucocytes 5,600 per cmm. Haemoglobin 32%.

Colour Index .64 . Specific Gravity 1036.

Case 3.

Margaret M---. Age 30. Domestic Servant.

She was a well-nourished girl with a somewhat pallid complexion. Her lips, gums, and conjunctivae, were of a pale pink colour. Most of the molar teeth were decayed. She had a very poor appetite, and complained of a feeling like a weight on her stomach after eating.

She had suffered greatly from constipation for some years; her bowels moved every two or three days, but a week sometimes passed without a motion.

Palpitation and shortness of breath were present on exertion. A harsh systolic murmur was present at all the cardiac areas, and was most marked/

marked at the pulmonary region. At the root of the neck a bruit de diable was audible.

Menstruation set in at the age of 17, occurring every four weeks, and lasting about a week. The blood loss was small, and great pain always accompanied each period.

Blood Examination.

Red Cells 4,300,000. White Cells 8,000. Haemoglobin 50%. ColourIndex .58.

Film - poikilocytosis present, red cells pale, blood platelets in great number.

The spleen was not enlarged.

Case 4.

Katie H--. Age 26. Domestic Servant.

The patient was a plump girl with a pallid complexion, shining eyes, and bluish sclerotics. Her conjunctivae, lips, and gums were pale red in colour, and there was no sign of oedema. Her teeth were very good, no decay being present.

She had/

She had no desire for food, and was troubled with occasional attacks of sickness after eating, before coming to hospital. There was tenderness on palpation over the epigastric region.

Marked constipation had existed for a year. Three, four, or five days passed without a motion before admission.

She suffered from breathlessness and palpitation on exertion. A systolic bruit was heard at the pulmonary area, but no bruit de diable was present.

Menstruation commenced at the age of 13, occurred regularly every 4 weeks, and lasted 6 or 7 days. The blood loss was copious, and pain always accompanied the periods. A white intermenstrual discharge was sometimes present.

The spleen was not enlarged.

Blood Examination.

The fresh blood was pink, and escaped freely from the prick. The red cells were paler than normal/

normal, and varied in shape and size. The blood platelets were numerous.

Erythrocytes 4,320,000. Haemoglobin 54% .

Leucocytes 6,600 . Specific Gravity 1048.

Colour Index .62 .

Case 5.

Catherine S---. Age 23. Domestic Servant.

She was a well-nourished girl with red cheeks, the rest of the face being pale. Her conjunctivae, lips, and gums were pale pink, and her sclerotics bluish in colour.

Her teeth were very much decayed.

She had a poor appetite, and complained of pain in the epigastric region. She had suffered from vomiting after food, but that had not been present for a year before admission.

Constipation had existed for 7 years, her bowels moving every 3 to 6 days.

She suffered from palpitation and shortness of breath/

breath on exertion. Haemic bruits were present at the pulmonary, and aortic areas.

Menstruation began at the age of 14. It was irregular occurring every two, three, or four weeks. The blood loss varied in quantity, being sometimes scanty, and at other times copious. Dysmenorrhoea was present.

The spleen was not enlarged.

Blood Examination.

Haemoglobin 70%. Red Cells 5,002,000.

White Cells 7,600. Colour Index .7 .

Case 6.

Sophia K--. Age 19. Tailoress.

She was a plump girl with a pallid complexion. Her conjunctivae, lips, and gums were pale red, and her sclerotics bluish in colour. She had a few decayed molars.

Her appetite was capricious, and she complained of pain in the lower part of the epigastric region.

She had/

She had been constipated for 6 weeks or longer before admission, having a motion every 3 or 4 days.

She suffered from shortness of breath, palpitation, and giddiness. Haemic bruits were present at the pulmonary, and mitral areas, and at the root of the neck.

Menstruation began at the age of 15, occurring every 4, 5,or6 weeks, lasting 1 or 2 days, and was always accompanied by pain. There had been no amenorrhoea.

Blood Examination.

The blood when drawn was of a pale red colour. The film showed the red cells to be paler than normal, and poikilocytosis was present.

Erythrocytes 4,000,000. Haemoglobin 60%.

Leucocytes 8,600. Colour Index .75 .

The spleen was not enlarged.

Case 7.

Ellen A--. Age 23. Scullery Maid.

She was/

She was a stout girl, with bright eyes, bluish sclerotics, and a complexion somewhat yellow-green in tint. Her lips, gums, and conjunctivae were of a pale pink colour. All her back teeth were decayed. She had no relish for food, and complained of thirst. She had been troubled by sickness after food before admission. She had had a liking for dry rice.

Constipation had existed for a few years, her bowels moving on the third or fourth day, but only after taking some purgative medicine.

She felt weak and unable for work . She suffered from palpitation, shortness of breath, and faintings, and had had attacks of dizziness while at work. A systolic bruit was present at the aortic, pulmonary, and mitral areas, and a bruit de diable was audible over the vessels at the root of the neck on the right side. She suffered from headaches, and sleeplessness, and before admission into hospital was very much depressed in spirits.

Menstruation/

Menstruation began when the patient was 16 years of age, occurred every 28 days, lasted 3 or 4 days- latterly 7 days- and was always accompanied by much pain.

The spleen was not enlarged.

Blood Examination.

The blood came freely from the prick, and was of a light red colour. The red cells were paler than normal, and there was marked poikilocytosis. The blood platelets were very numerous.

Red Cells 2,900,000. Haemoglobin 22%. Whites 5,000. Specific Gravity 1042. Colour Index .38 .

Case8.

Lizzie S--. Age 16. Message Girl.

She was a rather poorly-nourished girl with a pale face. Her lips, gums, and conjunctivae, were of a pale pink colour. Her sclerotics were bluish. She had very little appetite for food, and complained of thirst, and pain in the epigastrium after eating. She had/

She had occasional attacks of sickness and vomiting after food. There was some oedema of the feet and ankles. Her teeth were very much decayed.

She did not suffer from constipation.

Palpitation, shortness of breath, and dizziness were present after exertion. A systolic bruit was heard at the pulmonary, aortic, and mitral areas, and a distinct bruit de diable was audible at the root of the neck.

She suffered from neuralgia over the right eye.

Her spleen was slightly enlarged.

She had never menstruated.

Her mother and a sister had had anaemia.

Blood Examination.

The drop of fresh blood was paler than normal. Poikilocytosis was marked, and the blood platelets were very numerous.

Erythrocytes 2,600,000 per cmm. Haemoglobin 25%.

Leucocytes 6,000 percmm. Specific Gravity 1033.

Colour Index .48 .

SUMMARY of the SYMPTOMS, PHYSICAL SIGNS, andSTATE of the BLOOD, in cases of CHLOROSIS.

From a study of the cases just recorded, one might generalize the symptoms and physical signs as under:-

The chlorotic patient is plump, with a pallid, pink and white, or yellow-green complexion. Her eyes are brilliant, and the sclerotics of a bluish colour. The conjunctivae, lips, and gums, are paler than normal. The teeth may be decayed. Her face may be puffy, and there may be oedema of the feet and ankles. In disposition she is rather low-spirited and irritable. She suffers from breathlessness, palpitation, and faintings. Haemic murmurs are heard at the cardiac areas, chiefly pulmonary, and aortic, and at the root of the neck. The appetite is capricious. There may be distress after eating, and cardialgic attacks. She may have a fondness for unusual articles such as/

such as dry rice. Constipation is a prominent symptom. She may suffer from headache and neuralgia. Amenorrhoea or dysmenorrhoea are very often present.

State of the blood.

The drop of freshly drawn blood is paler than it should be.

Red Corpuscles. These are reduced in number, from 3,000,000 to 4,500,000 being about the number per cubic millimetre. The cells are pale in colour, vary in size, and are badly formed.

Haemoglobin. A percentage of from 30 to 60 is about the average. The colour index is about .5 .

Leucocytes. The white cells are reduced in number, but there is a comparative lympho-cytosis.

Blood platelets. These are increased in number.

In severe chlorosis some of the red cells stain blue with an ordinary blood stain such as Jenner's stain. About one in every five hundred cells is affected by this condition of Polychromasia. Nucleated red cells are not present as a rule.

FACTORS which are CONSTANT in CHLOROSIS.

Constipation, Disturbed Menstruation, and Gastric Disorders appear to be the conditions which most often precede or accompany the disease in its earlier stage. I shall now endeavour to touch on each of these in turn as the possible cause of chlorosis.

CONSTIPATION and AUTO - INTOXICATION.

Sir Andrew Clark[2] believed that the disease Chlorosis was in reality a poisoning, from the absorption of ptomaines and leucomaines from the large bowel.

This being true, can the toxic substance be detected in the blood of the diseased person?.

The blood platelets are known to be very much increased in number in chlorosis. They can be seen grouped in masses sometimes cylindrical in shape, and have/

and have been imputed as the cause of the thrombosis which occasionally occurs in these cases. Some authorities assert that these small bodies are not cells but debris present in the blood. If debris, are these small particles the result of the action of this toxic substance present in the blood. and having a haemolytic action on the red blood cells?.

If a destruction of red blood cells is taking place in any part of the circulatory system, one would expect that a similar destruction would be apparent, if the different constituents of the blood were mixed with each other outside the body, and kept under conditions, resembling as near as possible those, under which they exist in the body.

IN the attempts to further our knowledge of Immunity and the questions associated with it, the methods of research have changed as the work has advanced.

John Hunter found that putrefying fluid could be added in small quantity to fresh blood without setting up/

setting up putrefaction.

From small beginnings such as this, the elaborate but accurate laboratory methods of the present day have developed.

In 1888, Nuttall, working in Flugge's laboratory at Breslau, showed the anti-bacterial properties of blood serum, by means of experiments on living animals, and observations made outside the body on a warm stage. Since that time other observations have been made by Pfeiffer and others on the same lines.

Within recent years the means of reseach have been simplified. Metchnikoff and Bordet in France, Ehrlich and Morgenroth in Germany, and Muir and others in Britain have made observations by means of the analogous and much more readily studied Haemolysis, or solution of red blood corpuscles by foreign serum.

The action of human blood serum on the red blood corpuscles of the rabbit has been studied by Camus and Pagniez.[16] Strauss and Wolff[17] have shown the action on rabbits red blood corpuscles of transudates, and exudates/

and exudates, from various diseased conditions, such as spinal fluid from tubercular meningitis, ascitic fluid and fluid from oedema in cases of chronic interstitial nephritis and cirrhosis of the liver, also serum from cases of chronic nephritis, alcoholic peripheral neuritis, chronic rheumatism, etc.

The behaviour of human blood corpuscles in the presence of serum from various animals, and the haemolytic properties of normal serum on the blood corpuscles of animals has been studied by Marshall,[18] but up to the present, I do not find any work done on the action of serum from cases of Chlorosis on human red blood corpuscles.

The following is a description of the technique, and results of a few haemolytic experiments carried out by myself in the Materia Medica Laboratory of the Edinburgh University.

Technique of Haemolytic Work.

Blood Serum.

The serum was got from the patient by means of a cantharides blister. Before applying a 2"x2" blister, the skin was cleansed with lysol and water, then with methylated spirit, and finally with distilled water. The blister was punctured at the most dependent part, and the serum collected direct into a sterile test tube. A sterile surgical needle or sterile scissors were used to make the puncture, and the surface of the blister was carefully washed with distilled water before the puncture was made.

Red Blood Corpuscles.

Into a sterile pipette 1cc. of sterile salt solution-less .05 cc. for blood-was drawn and blown into a sterile test tube. The blood was got from my own finger or from the patient's ear. The part from which the blood was to be drawn was washed with lysol and water and then with sterile salt solution, dried with sterile/

with sterile wool, and then pricked with a sterile needle. Blood was sucked up into a sterile pipette, the quantity taken being .05 cc, and this was blown into the test tube containing the measured quantity of salt solution. These were then intimately mixed by shaking gently. After a mark had been made on the test tube to show the upper limit of the mixture, the tube and its contents were centrifuged for ten minutes. On removing from the centrifuge the super--natant fluid was drawn off, and the test tube filled up to the mark with fresh sterile salt solution. It was again centrifuged and filled up afresh, and after the same process had been gone through for a third time, the suspension of washed red blood corpuscles was ready for use.

All test tubes and pipettes used, were sterilized by keeping them at a temperature of about 150° C. for from one to two hours. The metal instruments were sterilized by boiling for twenty minutes. Test tubes were plugged with sterile wool.

The salt/

The salt solution used was a mixture of potassium oxalate and sodium chloride, in the ratio of .25 potassium oxalate to .85 sodium chloride.

Method followed during observations.

In each instance, one endeavoured to find out whether or not the serum was capable of dissolving the red corpuscles of the individual from whom it was taken, and also those of a normal individual.

Each experiment was carried out as follows:-

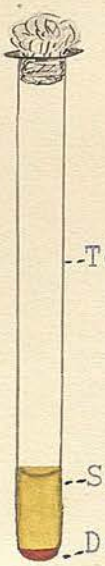
Equal quantities of serum and washed red corpuscle suspension - 1cc. - were mixed in a sterile test tube and allowed to stand in an incubator at 37° C. A control was made in each instance. The tubes were examined at two hours, eight hours, and twenty-four hours after they had been placed in the thermostat. The temperature of the incubator was kept as near as possible at 37° C. or 37.5° C. but it varied one degree or so up or down with the changes of temperature of the room.

Sketch

of

Result a.

Case 1.



HAEMOLYTIC EXPERIMENTS.

Case 1.

Mary C--. Age 18. Dressmaker.

She complained of shortness of breath and palpitation on exertion. The appetite was capricious, and she suffered pain in the epigastric region after eating. Constipation had been marked for years.

Blood Examination.

Red Cells 4,500,000 per cmm. Haemoglobin 50%. White Cells 6,000. Colour Index .5 .

The red cells were paler than normal, and there was poikilocytosis.

Results of Observations.

a. 1cc. serum from patient + 1cc. suspension patient's reds

b. 1cc. serum from patient + 1cc. suspension my own reds

No Haemolysis within 24 Hours.

Case 2.

Jessie S--. Age 22 . Domestic Servant.

This patient complained of always feeling tired. She had irregular Menstruation. Constipation had been present for as long as she could remember, her bowels moving on the third or fourth day. She had a feeling of weight in the epigastric region after eating, and had no desire for food. Breathlessness always followed any slight exertion.

Blood Examination.

Red Cells 4,000,000 per cmm. Haemoglobin 60%. White Cells 7,000. Colour Index .7 . The film showed slight poikilocytosis.

Results of Observations.

The serum from this patient was found to have no haemolytic action within 24 hours on the washed red blood corpuscles from the same patient or on those of my own blood.

Case 3.

Janet N--. Age 20. House-wife.

This patient was a typical looking case of chlorosis. She was pallid, breathless, constipated, with a poor appetite. Haemic murmurs were present at the base of the heart and root of the neck.

Blood Examination.

Red Cells 3,200,000 Haemoglobin 35%.

White Cells 6,800. Colour Index .5 . The red cells were paler than normal, and poikilocytosis was present.

Results of Observations.

a. 1cc.patients serum + 1cc.suspension patient's reds.

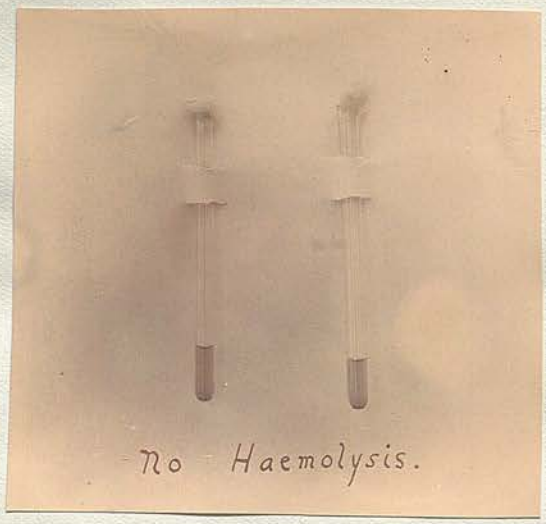
b. 1cc.patients serum + 1cc.suspension my own reds.

No Haemolysis within 24 Hours.

Case 4.

Mary M--. Age 16. Travelling-show girl.

She was a well-developed girl with a pink and white complexion. Her conjunctivae, lips, and gums were pale/



Photograph of Results a. and b.

Case 4.

These tubes presented the same appearance as that sketched Case 1. The less dark part is the Serum and the very dark part, small and not very visible, at the bottom of the tube is the deposit of washed red blood corpuscles.

were pale pink, and her teeth were very much decayed. She had a good appetite but suffered from a pain of a gripping character coming on about an hour after eating. Her bowels moved once a day as a rule.

Haemic murmurs were present at the mitral and pulmonary areas, and a bruit de diable was heard at the root of the neck. She had Amenorrhoea.

Blood Examination.

Red Cells 3,710,000 per cmm. Haemoglobin 38%.

White Cells 5,400 per cmm. Colour Index .51 .

Specific Gravity 1040. The red cells were paler than normal, and poikilocytosis was present.

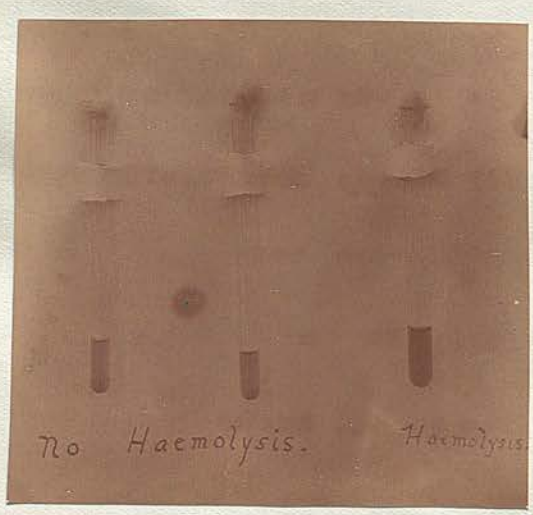
(I am indebted to Dr. McNeil for the blood examinations of cases 4 and 5.)

Results of Observations.

a. 1cc.patients serum + 1cc.suspension patient's reds.

b. 1cc.patients serum + 1cc.suspension my own reds.

No Haemolysis within 24 Hours.



Comparison of No Haemolysis and Haemolysis.

The two tubes on the left are those described on the previous page and showing a Negative Result; the one on the right shows a positive haemolytic result distilled water having been added instead of serum.

The tube on the right is darker than the other two.

Case 5.

Mary A--. Age 43. Pot Glazer.

She was a pale-faced woman poorly developed. Her appetite was good and she had no pain or discomfort after eating. Defaecation was regular. She complained of shooting pains in the legs, great weakness, and palpitation and shortness of breath on exertion. A faint systolic murmur was present at the mitral, aortic, and pulmonary areas. Menstruation was regular but scanty.

Blood Examination.

Red Cells 3,790,000per cmm. Haemoglobin 36%.

White Cells 5,200.per cmm. ColourIndex .47 .

Specific Gravity 1038.

Results of Observations.

a.1cc.patients serum + 1cc.suspension patient's reds.

b. 1cc. patients serum + 1cc.suspension my own reds.

No Haemolysis within 24 Hours.

These experiments, although not exhaustive, and carried out by means of blister serum, appear to show that in all probability there is no toxic substance having a marked haemolytic action on the red blood corpuscles, present in the blood serum of cases of Chlorosis.

Similar work has been done in Germany since these observations were made. Donatti and Landsteiner[19] have studied the haemolytic action of serum from various anaemias, among which were four cases of Chlorosis, and in every instance a negative result was got.

The destruction theory does not seem to be at all the correct one. There appears to be no haemolytic action taking place in the blood. It is said to occur in the spleen, the enlargement of that organ being given as evidence, but the spleen is not enlarged in all cases. IT has been proved by trustworthy investigators, that there is neither excessive formation of decomposition products in the intestinal canal/

intestinal canal, nor any excessive breaking down of the red corpuscles.

The very pale colour of the urine and frequently also of the faeces, according to Von Noorden[8], indicates, that less colouring matter than usual is being furnished by the haemoglobin, and hence that fewer red corpuscles are breaking down.

Lipman & Wulf[9] have shown that in Chlorosis increased intestinal putrefaction is not commonly present, nor is there increased excretion of the deriratives of haemoglobin.

Sulphate of Iron will cure the disease, whereas Bismuth and some other absorbents of H_2S will not. This has been clearly proved by Stockman.[10]

Zander[20] considered Hydrochloric Acid on account of its antiseptic qualities to be a cure for chlorosis. Stockman[10] has shown that Hydrochloric Acid alone will not effect a cure. He has also proved that purgatives alone will not cure the disease, and points out that Sir Andrew Clark's purgatives were combined with Iron.

The views/

The views of Clark, Bunge, and others are thus refuted.

The Theory of Auto-intoxication appears to be untenable when one considers the frequency with which constipation occurs in women and sometimes also in men. If ptomaines and leucomaines are absorbed under these conditions, one would expect them to be absorbed in all such cases and an anaemia result, but this does not take place. In the majority of constipation cases there is either no anaemia or practically none. A true chlorosis is not known to have ever occurred in a male. Many cases of constipation appear to be in perfect health regardless of their condition. Not a few cases of chlorosis do not suffer from constipation.

HYPOPLASIA of the UTERUS and OVARIES, and its RELATION to the ETIOLOGY of CHLOROSIS.

Since the year 1856, when Rotitansky[12] stated that chlorosis was due to an imperfect development of the uterus and ovaries, many observations have been made on the subject, but up to the present the question has not been definitely settled. Virchow[11] in 1872 corroborated Rotitansky's view, and showed that in some cases of chlorosis a hypoplasia of the organs of generation existed along with a hypoplasia of the circulatory organs.

Many patients suffering from chlorosis have disturbance of menstruation. The majority of such cases have either Amenorrhoea or Dysmenorrhoea, conditions which always accompany an imperfect development of the uterus and ovaries.

To answer the question - Is chlorosis due to an imperfect development of the uterus and ovaries? - I set/

I set myself the task to find out if persons with a small uterus and small ovaries had also chlorosis.

The blood of each patient was examined in the following manner:-

Blood was obtained by pricking the lobe of the ear, which was first of all cleansed with ether, and then briskly rubbed to make it hyperaemic.

The Red Corpuscles and Leucocytes were counted by means of a Thoma-Zeiss Haemocytometer. The dilution used was 1 in 200 for the red cells, and 1 in 20 for the white cells. The diluting fluids were Hayem's solution for the erythrocytes, and a mixture of glacial acetic acid and distilled water coloured with methyl--green for the leucocytes.

Five sets of sixteen squares were counted in enumerating the red cells, and four hundred small squares in counting the leucocytes.

The percentage of Haemoglobin was estimated by means of a Gower's Haemoglobinometer.

Blood films were made on cover slips and stained with Jenner's stain. For a differential count 500 leucocytes were counted.

The following are a few cases in which the uterus was imperfectly developed, with the result of the blood examination in each case.

Case 1.

Mrs S--. Age 34. House-wife.

Married for eight years. She has had no children and no miscarriages.

Complaint. Pain at periods, and yellow discharge between the periods.

Present Illness. Patient has always had pain at her periods, worst the first day. For the last three months she has had a yellow intermenstrual discharge with an offensive odour.

Menstruation started at the age of 14. The periods occurred regularly every 4 weeks, and lasted from 7 to 10 days. The amount was fairly profuse, and the discharge was always slightly clotted. Pain always accompanied the onset of the flow.

Intermenstrual Discharge as noted above.

Previous Illnesses. She had had the usual diseases/

diseases of childhood, and Influenza 12 years ago. When a young girl she had been treated for anaemia.

Family History. Nothing to note.

Other Systems. Nothing to note.

Physical Examination.

The uterus is small and acutely anteflexed. There is shortening of the right utero-sacral ligament and the uterus is pulled over to the right side. The ovaries appear to be of normal size.

Blood Examination.

Erythrocytes 4,650,000 per cmm. Haemoglobin 92%. Colour Index. 1 . White Cells 6,000. Differential Count - Polymorphonuclear neutrophile leucocytes 73%, Lymphocytes 23%, Eosinophile leucocytes 4%.

The fresh blood from the prick was of a dark red colour, and the individual cells were well formed.

Case 2.

Mrs F--. Age 22. No occupation.

Married for 14 months. No children. She has had two miscarriages.

Complaint. Pain in hips and painful menstruation.

Present Illness. She has always had some pain at her periods but this has been worse lately. She had two miscarriages- one in February 1905, and one in December 1905 - since then the pain at her periods has been worse. and menstruation has been more profuse.

Menstruation began at the age of fourteen. It has been regular every 24 days,and lasted 5 days.

She has had a slight white discharge since just before marriage.

Defaecation,regular.

Previous Illnesses. She has been treated for bloodlessness at intervals up to two years ago.

Other Systems. Nothing to note.

Physical Examination.

The uterus is small, congenitally anteflexed, retroposed/

retroposed, and fixed towards the right side. The left ovary is low placed but not enlarged.

Blood Examination.

Red Corpuscles-4,500,000 per cmm.

Haemoglobin 89%. Colour Index .98 .

Leucocytes-8,000 per cmm.

Differential Count -Polymorphs 65%, Lymphocytes 33%, Eosinophiles 1%.

Case 3.

Mrs C--. Age 30. House-wife.

Married 2 years. No children. No miscarriages.

Complaint. Pain low down in the left side and back. Painful intercourse.

Present Illness. For the last 5 years she has had pain low down in the left side and back,varying in severity. The pain was always worse at her periods. Since marriage she has had pain during coitus.

Menstruation started when she was 18. It has always/

always been irregular. The flow lasted 4 or 5 days, varied in amount sometimes being profuse. The discharge was generally thick and dark and at times clotted. The pain became severe a week before the onset of the menses, and lasted till the cessation of the flow.

Constipation has been marked since marriage.

Previous Health. She has never been strong. She has been subject to attacks of breathlessness on exertion for many years, and has been treated for bloodlessness on more than one occasion.

Other Systems. Nothing to note.

Physical Examination. The cervix is long and conical with a pin-hole os. The uterus is small and acutely anteflexed. Both ovaries are slightly enlarged and the left one is prolapsed.

Blood Examination. Erythrocytes-4,850,000 per cmm. Haemoglobin 98%. Colour Index 1. White Cells8,000 p.cmm. Differential Count - Polymorphs 60%, Lymphocytes 36%, Eosinophiles 4%.

Case 4.

Mrs B--. Age 24. NO occupation.

Married 10 months , No children, No miscarriages.

Complaint-pain in the back and left side.

Present Illness. Patient had a flooding in August 1905 which may have been a miscarriage, and since then she has had continuous pain in the back and left side.

Menstruation began when patient was 16 , occurred regularly every 4 weeks, and lasted 5 days. The discharge was rather profuse and always inclined to be clotted. Pain always accompanied the period and was worst the first day. She had an occasional white intermenstrual discharge.

Defaecation. Bowels very regular.

General Health. She suffered from attacks of breathlessness and palpitation on exertion. She had suffered from anaemia for years and had been treated for it at intervals.

Physical Examination. The cervix is soft. The

uterus/

uterus is small and acutely anteflexed. The ovaries are of normal size.

Blood Examination.

Red Cells - 4,000,000 per cmm. Haemoglobin 85%. White Cells - 8,000 per cmm. Colour Index 1.

The blood was dark red in colour, and the red cells well formed.

Differential Count - Polymorphs 65%, Lymphocytes 32%, Eosinophiles 3%.

Case 5.

Mrs G--. Age 27. House-wife.

Married 4 years. No children. No miscarriages.

Complaint. At periods, she has great pain.

Present Illness. Patient has always had pain at her periods but it has been much worse since marriage.

Menstruation commenced at the age of 14. The periods occurred regularly every 4 weeks and lasted 4 days./

4 days. The discharge was profuse in amount and was sometimes clotted. Pain came on immediately before each period and continued for the first two days of the flow.

Defaecation. She has been very constipated for the last 9 months.

Her general health is good.

Previous Illnesses. She has suffered from attacks of anæmia. The last attack for which she was treated occurred 5 years ago.

Physical Examination.

The uterus is small and congenitally anteflexed. The cervix is eroded round the external os. The left ovary is slightly enlarged.

Blood Examination.

Red Cells-4,500,000 per cmm.

Haemoglobin 90%. Colour Index 1. White Cells-7,500. Differential Count - Polymorphs 67%, Lymphocytes 32%, Eosinophiles 1%.

Case 6.

Mrs F--. Age 24. House-wife.

Married 3 years. No children. No miscarriages.

Complaint. Pain in the back and right side.

Present Illness. The pain has been present for some years but has been worse for the last four weeks. It is not constant, is worst when she exerts herself, or after sitting for some time.

Menstruation began at the age of 14, occurred regularly every 4 weeks and lasted 3 days. The discharge was scanty but quite natural in character. Pain always accompanied the onset of the flow.

A white intermenstrual discharge has been present for years.

Defaecation is regular.

She suffers from breathlessness on exertion.

She was treated for bloodlessness when a girl.

Physical Examination.

The uterus is small and acutely anteflexed. The cervix is small. The ovaries are normal in size and the /

and the left one appears to be slightly prolapsed.

Blood Examination.

Red Corpuscles. 4,320,000 per cmm.

Haemoglobin 80%. Colour Index .92 .White Cells 6,200 per cmm.

Differential Count. Polymorphs 70%, Lymphocytes 28%, Eosinophiles 2%.

Case 7.

Mrs F--. Age 29. House-wife.

Married 9½ years. No children. No miscarriages.

Complaint. Severe pain before periods.

Present Illness. Since her marriage she has had severe pain coming on two days before each period and lasting till the cessation of menstruation.

Menstruation began at the age of 15. The menses occur regularly every four weeks, and last 2or 3 days. The flow is scanty. There is no clotting.

Defaecation is fairly regular.

General Health/

General Health. She feels weak and out of sorts. She is a somewhat pallid, neurotic looking woman.

Previous Illnesses. Measles, Influenza, and Bloodlessness some years ago.

Physical Examination.

The uterus is very small, acutely anteflexed, and retroposed. The cervix is small and conical. The appendages are not enlarged.

Blood Examination.

Red Cells. 4,800,000 per cmm. Haemoglobin 95%.
White Cells. 8,000 per cmm. Colour Index .98 .
Differential Count. Polymorphs 64%, Lymphocytes 33%, Eosinophiles 3%.

The fresh blood was of a dark red colour and the red cells were well formed.

Case 8.

Miss McG--. Age 26. Dressmaker.

Complaint. Pain in the left side, and irregular menstruation.

Present Illness. For the last three years she has had pain low down in the left side, worst just before her periods, and when she exerts herself in any way.

Menstruation started at the age of fourteen. It occurred regularly till the patient was 20 yearsold, and it has been irregular since. The periods lasted 2 or 3 days and the discharge was scanty and sometimes clotted. The pain becomes very severe a week before the period and gets less as the flow is established.

Defaecation. Constipation is marked.

The patient is a well-nourished and well--developed girl, but complains of being easily made tired.

Previous Illnesses. Scarlet Fever, Measles, Pleurisy. Four years ago she was treated for anaemia, she was very breathless and looked green.

Physical Examination.

The uterus is very small,and acutely anteflexed. The ovaries/

The ovaries are low placed and feel as large as the uterus.

Blood Examination.

Red Cells. 4,200,000 per cmm. Haemoglobin 80%.

White Cells 7,800 per cmm. Colour Index .95 .

Differential Count. Polymorphs 69%, Lymphocytes 27%, Eosinophiles 4%.

The freshly drawn blood was dark red in colour.

Case 9.

Miss W--. Age 27. Assists with house-work.

Complaint. Pain in the left side especially at the periods.

Present Illness. She has always had severe pain the day before the onset of her periods and for the first two days of the flow. About a year ago she began to have pain low down in the left side. She was treated for this with medicine and the pain went away. The pain/

The pain returned a month ago more severe than at first. She had also pain in her back and her legs felt tired.

Menstruation began at the age of twelve. It was very irregular and as a rule lasted 4 days. The blood loss was slight, and the character of the discharge natural. A white intermenstrual discharge had existed for some years.

Her bowels were very constipated.

General Health. She was easily tired , suffered from headaches, and became breathless on the least exertion.

Previous Illnesses. Scarlet Fever, and Measles as a child. Congestion of the liver and kidneys 3 years ago. She has been bloodless at intervals for many years . The last time she took medicine for it was about six months ago.

The patient is thin and rather pale with a pink tinge in her cheeks.

There is a systolic bruit at the pulmonary area.

Other Systems/

Other Systems. Nothing to note.

Physical Examination. The uterus is small and acutely anteflexed. The cervix is conical in shape with a pin-hole os. The ovaries are of normal size.

Blood Examination.

Red Cells. 4,800,000 per cmm. Haemoglobin 54%.

White Cells. 8,200 per cmm. Colour Index .56 .

The fresh blood is of a light red colour and is more fluid than normal.

Differential Count. Polymorphs. 65%, Lymphocytes 32%. Eosinophiles 3%.

Case 10.

Mrs C--. Age 25. House-wife.

Married one year. No children. She had had one miscarriage at the second month.

Complaint. Pain at periods and flooding.

Present Illness. Three months ago patient had a miscarriage accompanied by great loss of blood. She did not/

did not lie up after the abortion. Since then she has had irregular bleedings, and pain in the right side.

Menstruation started at the age of 15, occurred regularly every 4 weeks till the miscarriage, and lasted 4 days. Since the miscarriage she could never tell when the menses were present. The amount of blood loss was not excessive before the present illness. Pain has accompanied menstruation for some time, but has been much more severe for the last 3 months. She had a slight white intermenstrual discharge before the abortion , this has been profuse since.

Her bowels are always regular.

General Health. She has got much thinner lately and is subject to faintings.

The patient used to be a nurse, and at that time she suffered from breathlessness and palpitation but was never treated for anaemia.

Other Systems. Nothing to note.

Physical Examination.

The uterus/

The uterus is small and of poor muscularity. The cervix is nearly as large as the body of the uterus. The appendages are not enlarged.

Blood Examination.

Erythrocytes. 4,000,000 per cmm.

Haemoglobin 75%. Colour Index .93 .

White Cells. 7,800 per cmm.

The blood fresh from the prick is dark red in colour.

Differential Count of the Leucocytes.

Polymorphs. 72%, Lymphocytes 26%, Eosinophiles 2%.

Case 11.

Mrs L--. Age 32. House-wife.

Married 3 years. No children. Four months after her marriage she had a severe flooding which might have been a miscarriage.

Complaint. Irregular menstruation and pain at the periods.

Menstruation began at the age of 13, and occurred regularly every 4 weeks till she was 29 years old. The flow/

The flow lasted 4 days and was accompanied by great pain. For the last 3 years menstruation has been very irregular.

A white intermenstrual discharge has been present for many years.

Constipation has existed for years.

General Health. The patient is a stout pallid woman. She suffers from headaches, and has breathlessness and palpitation on exertion. She is readily fatigued.

Previous Illnesses. Rheumatic Fever at the ages of 16 and 21 . She had Whooping-Cough in infancy.

Family History. Nothing to note.

Other Systems. Nothing to note.

Physical Examination.

The uterus is small and acutely anteflexed. The ovaries appear to be of normal size.

Blood Examination.

Red Cells. 4,640,000 per cmm. Haemoglobin 83%.

White Cells. 8,400 per cmm. Colour Index .9 .

Differential Count/

Differential Count. Polymorphs 74%, Lymphocytes23%, Eosinophiles 3%.

Case 12.

Mrs R--. Age 28. House-wife.

Married 2 years. NO children. NO miscarriages.

Complaint. Sterility.

Menstruation began at the age of 15, occurred regularly every 3 weeks, and lasted 3 days. The flow was copious and accompanied by pain the first day. There was no clotting.

Present Illness. She has had pain in the back for 6 months and feels fatigued after stooping.

She has been very bloodless twice. The last time she was treated for it was 3 years ago.

Defaecation is regular.

The patient is a pale but well-nourished woman. The lower lids are oedematous. She is breathless on exertion. A systolic murmur is present at the pulmonary area.

Physical Examination/

Physical Examination.

The vagina is contracted in its upper part. The uterus is small and acutely anteflexed, and pulled over towards the right side. The cervix is small and conical with a pin-hole os. The ovaries are of normal size.

Blood Examination.

The fresh drop is dark red in colour.
Red Cells. 4,000,000 per cmm. Haemoglobin78%.
Leucocytes. 7,400 per cmm. Colour Index .97 .
Differential Count. Polymorphs 68%, Lymphocytes 28%, Eosinophiles 4%.

Case 13.

Harriet M--. Age 20. Tailoress.

Complaint. Irregular periods.

Menstruation began at the age of 15. It has never been regular. At times she missed 2 or3 months. The periods when present lasted 2 or 3 days. The blood loss/

blood loss was slight. She had pain the day before the onset of the flow.

Defaecation. She is somewhat constipated. Her bowels move every second day.

Previous Illnesses. Measles, Hernia. She was treated for bloodlessness 4 years ago.

She is a well-nourished girl with a pink and white complexion. Her conjunctivae, lips, and gums are a pale pink in colour. Her molar teeth are very much decayed and all her upper incisors have been extracted.

She has breathlessness and palpitation on exertion and feels sleepy after eating.

There is a faint systolic murmur at the pulmonary area.

Other Systems. Nothing to note.

Physical Examination.

The cervix is small and conical. The uterus is very small and acutely anteflexed. The ovaries appear normal.

Blood Examination/

Blood Examination.

The fresh drop of blood is of a pale red colour.

Erythrocytes. 4,000,000 per cmm. Haemoglobin 75%.

Leucocytes. 6,800 per cmm. Colour Index .9 .

Differential Count. Polymorphs 68%, Lymphocytes 31%,

Eosinophiles 1%.

Case 14.

Mrs S--. Age 34. House-wife.

Married 4 years. No children. No miscarriages.

Complaint. Pain in right side and headaches.

Present Illness. For the last six years she has had sick turns every month. These started with a pain low down in the right side, about a week before her period was due. This pain was usually sharp in character and radiated round to the front of the thigh, and was worse on stooping or working.

Menstruation began at the age of 16, was absent for a year, and has since been regular every 4 weeks. The flow lasts 5 days, is more or less clotted, and varies in/

varies in amount. Pain and sickness have accompanied menstruation for the last six years. She has had an intermenstrual discharge for some years, sometimes white and sometimes yellow.

General Health. She is troubled by severe headaches, and is readily made to feel tired.

Previous Illnesses. She had Scarlet Fever, Measles, and Chicken Pox when a child. She has had repeated attacks of bloodlessness for which she has been treated several times. Constipation is marked.

Physical Examination.

The uterus is small, acutely anteflexed, and retroverted. The cervix is small, conical, and the external os is of the pin-hole variety. The ovaries are not enlarged.

Blood Examination.

Red Cells. 4,000,000 per cmm. Haemoglobin 72%.
White Cells. 6,600 per cmm. Colour Index .9 .
Differential Count. Polymorphs 68%, Lymphocytes 28%, Eosinophiles 4%.

Case 15.

Mrs A--. Age 26. House-wife.

Married 3 years. No children. No miscarriages.

Complaint. Pain at the periods.

Present Illness. She has always had pain at her periods, but in July 1905 the pain got much worse, and is still very severe. The pain begins about a week before the period is due, and lasts till the cessation of the flow. It starts low down in the left side, radiates through to the back, and ends up in the right thigh. For the last few weeks the pain has been almost constantly present.

Menstruation commenced when the patient was ten years of age. It occurred regularly every four weeks till her marriage but it has been less regular since. The duration of the flow is two or three days, and the amount of blood loss is small. Pain always accompanies menstruation as described above.

Defaecation. Constipation is present and has existed for some years.

Micturition/

Micturition. There has been increased frequency of late. No pain.

General Health. She suffers from temporal headaches which have been worse lately.

Previous Illnesses. For a number of years she has had attacks of breathlessness on exertion. Her Doctor told her she was bloodless and she has taken pills for the anaemia.

Other Systems. Nothing to note.

Physical Examination.

The vagina is narrow. The uterus is very small and acutely anteflexed. The ovaries appear to be normal.

Blood Examination.

Red Cells . 4,500,000 per cmm. Haemoglobin 92%.

White Cells. 7,000 per cmm. Colour Index 1 .

Differential Count. Polymorphs 69%, Lymphocytes 30%, Eosinophiles 1%.

The fresh blood is dark red in colour.

It will be noted from a study of the blood examinations of these cases of imperfectly developed uteri that, in only one instance does the blood resemble that of a case of chlorosis. In that case - Miss W--. Case 9. - the colour index is .56, and the other characters of the blood also agree with those of the blood in Chlorosis. Her symptoms also correspond with those present in such cases.

It would appear evident from these observations that a badly developed uterus is not the factor necessary for the causation of Chlorosis.

It is impossible by means of a physical examination alone, to tell whether or not the ovaries are badly developed. However, there are cases from which a certain degree of enlightenment can be obtained, namely - Cases in which both ovaries have been removed and the patient is still at an age when menstruation could take place. These cases seemed to me to be to a certain extent allied to cases of chlorosis. They are fat and plump as a rule, somewhat pallid/

somewhat pallid, suffer from breathlessness, and have amenorrhoea.

The following are the results of the blood examination of a few such cases.

Case 1.

Mrs Y-- . Age 40. Cook.

She is a stout woman with a pallid complexion, suffers greatly from breathlessness and palpitation on exertion, and has amenorrhoea.

Both ovaries were removed 14 years ago, in March 1892.

Blood Examination.

Red Cells. 4,000,000 per cmm.

Haemoglobin 88%. Colour Index 1.1 .

Leucocytes. 6,600 per cmm.

The red cells are of good colour and there is no poikilocytosis present.

Case 2.

Miss E--. Age 32. House-wife.

This patient/

This patient is thin, and complains of vomiting after eating. She does not suffer from breathlessness and palpitation on exertion. She has amenorrhoea.

Both ovaries were removed 8 years ago, March 1898.

Blood Examination.

Red Cells. 4,160,000 per cmm. Haemoglobin 74%.

White Cells. 10,000 per cmm. Colour Index .9 .

The red cells are well formed.

Case 3.

Mrs H--. Age 36. House-wife.

She is a stout woman with a greyish-white complexion. She suffers greatly from breathlessness and palpitation on exertion. She has amenorrhoea.

Both ovaries were removed about a year ago, in March 1905.

Blood Examination.

Red Cells. 4,000,000 per cmm. Haemoglobin 72%.

White Cells. 8,400 per cmm. Colour Index .9 .

The red cells are mostly in the form of rouleaux.

Case 4.

Miss M--. Age 36. No occupation.

She is stout, somewhat pallid, suffers from breathlessness and palpitation on the least exertion, and she has amenorrhoea.

Both ovaries were removed 5 months ago.

Blood Examination.

Red Cells. 3,500,000 per cmm. Haemoglobin 80%.

White Cells. 6,000 per cmm. Colour Index 1.1 .

The red cells are of good colour and well formed.

When there is no marked deficiency of the blood associated with a total absence of the ovaries, one would be inclined to form the opinion that an imperfect development of the ovaries would also be unassociated with any degree of anaemia.

It would therefore appear that a hypoplasia of the uterus and ovaries is not the factor to which the condition of chlorosis is due. Further evidence as/

evidence as to the improbability of defective development of the uterus and ovaries as being the cause, is the fact, that chlorosis lasts as a rule for such a short time as a few weeks or months, or at the most for a few years, and is completely and permanently recovered from, whereas the condition of hypoplasia of the generative organs is lasting or remains at least for many years.

It is more probable that the hypoplasia follows the anaemia, the imperfect development resulting from the malnutrition consequent on the deficient blood supply to these parts. There was in all these cases of mal-developed uteri which I have recorded, with two exceptions, a history of anaemia having occurred at an earlier date. These exceptions were Mrs C--. Case 10. and Mrs L--. Case 11., and they had a history of having suffered from breathlessness and palpitation, therefore they might possibly have been anaemic although not treated for it.

GASTRIC DISORDERS.

The great majority of patients suffering from chlorosis, if not all, have disturbed digestion. Five of the eight cases which I have recorded had gastric trouble and the other three had impaired appetite.

It has been stated that the gastric disturbances occurring in cases of chlorosis, result in consequence of the anaemia. The presence of decayed teeth, a condition which is so often met with in chlorosis, might be suggested as the cause of the dyspepsia and other stomach troubles, but in three of the eight cases referred to, well-marked gastric disturbance existed and at the same time the teeth were perfect.

On the other hand, might not the disturbed digestion be the cause of the chlorosis?.

When one has to rely on a patient's memory alone, it is difficult to get conclusive evidence as to the/

to the exact order in which the various symptoms occurred at the commencement of a disease. I therefore find it impossible to state facts as to the relation of the gastric disturbances to the onset of the anaemia.

Disorders of digestion may precede the anaemia, but it also appears probable that they result from the strain of rapid growth which is present at the age when chlorosis is most prevalent, and which one would expect to derange all the functions of the body, unless the organism reacted in such a way as to be able to overcome this strain.

C O N C L U S I O N .

The results of the few haemolytic experiments appear to show, that there is no marked haemolysis when the blood corpuscles and the serum of chlorotic cases are in contact in vitro, and render it probable that no such action takes place in vivo.

It also appears improbable that a destructive action goes on in the spleen, as the spleen is not enlarged in every case of chlorosis.

Von Noorden's evidence as to the pale colour of the urine, and occasionally of the faeces of these cases, seems to indicate that there is no abnormal destruction of the red corpuscles taking place in any part of the body in this condition.

The reduction of haemoglobin is thus due, either to a diminished production, or, the supply remaining the same, a blood loss is taking place.

The almost exclusive occurrence of the disease near/

disease near the establishment of menstruation must prove any theory of etiology inadequate, which fails to consider the age of puberty, the female sex, and the function of menstruation.

In both sexes at the age of puberty, the organism has to contend with the strain of rapid growth. The young girl at this age has a still greater strain put upon her with the onset of the menses. The organism may not be able to respond to this double strain, and might even under a long--continued strain be weakened, and less able to cope with the demands made upon it.

There are no facts to prove that a break--down of the blood-forming mechanism does occur and the production thus rendered abnormally small. As far as I am aware no scientific examination has ever been made of the bone-marrow of these cases. Chlorosis is not a fatal disease and bone-marrow cannot be got for examination except on such rare occasions as when a case of chlorosis has met with an accident/

an accident requiring the removal of a piece of bone or an amputation.

Even if the production of blood was the same as that which took place before the additional strain of menstruation was added, the great blood loss which takes place every month would appear to be sufficient to cause the onset of an anaemia.

It appears to be probable that Chlorosis results from the inability of the organism to overcome this strain. This incapacity may be the issue of an imperfect mode of life, or an imperfect state of health. Among the many conditions which might lead to this weakening of the organism are:- 1. An imperfect dietary. 2. Deficient air, exercise, and light. 3. Overwork, mental or physical. 4. Digestive, uterine, nervous, or other disorders.

As a means of prophylaxis it would seem to be necessary, that the strength of young girls should be sustained, from just before the age of puberty till menstruation has been well established.

To this end particular attention should be paid to the diet. Food which is plain, easily digested, perfectly cooked, and nourishing would appear to be of such a nature as is best suited to their needs.

All conditions of life which will tend to fatigue them mentally or physically should be avoided. If the girl is at school her intellectual labours ought to be curtailed to a minimum. Three or at least four hours of study would be quite long enough for a girl at this time. They should be guarded against worry, or any condition likely to cause undue excitement.

Out-door exercise ought to be indulged in to an extent short of fatigue. At all times they should be breathing pure fresh air.

In short/

In short a girl should, until she reaches womanhood at least, lead a simple life based on hygienic principles.

I thank Professor Sir Thomas Fraser for his kindness in allowing me to make use of the cases of anaemia,

Dr. N.T.Brewis for his kind permission to use the gynaecological cases, and

Dr Eason for his valuable assistance in the technique of the haemolytic work.

REFERENCES.

1 Osler - Principles and Practice of Medicine.1905.page 721.

2 Clark - Lancet. 1887. No.2. page 1003.

3 Bouchard - Leçons sur l'autointoxication. Paris. 1887.

4 Hoffmann - Lehrb.d.Constitutionskrank. 1893. page 39.

5 Nothnagel - Wien. Med. Presse. 1891. No.51.page 1934.

6 Forchheimer - Amer. Jour. of Med. Scien. 1893. Vol.106. page 8.

7 Bunge - Verh. Cong. Inn. Med. 1895. page 142.

8 Von Noorden - Berl. Klin. Woch. 1895. No.9. pages 181 & 214.

9 Lipman & Wulf - Von Noorden's Beitr.z.Lehre vom Stoffwechsel. 1892. Heft 1.

10 Stockman - Brit. Med. Jour. 1893. Vol.1. pages 880 & 942.

11 Virchow - Ueber die Chlorose. Berlin. 1872.

12 Rokitansky - Lehr.d.Path.Anat. Vol.2. 1856.

13 Murri - La Semaine Medicale. 1894. page 162.

14 Klin. Path. des Blutes. 1896. page 76.

15 Meinert - Sammlung. Klin. Vorträge. 1895. No.35.

16 Camus & Pagniez - Société de Biologie. 1901. page 242.

17 Strauss & Wolff - Fortschrit. d. Mediz. xx. 1. 1902.

18 Marshall - Jour. of Exper. Med. Vol.6. No.s 4,5,& 6. 1905.

19 Donatti & Landsteiner - Zeit.f.Klin. Mediz. Berlin. 1905.
Band 52. Heft 1 & 2.

20 Zander - Virchow's Arch. Bd.84. 1881.